

Power Generation and Water Treatment Using Sediment Microbial Fuel Cells (SMFCs)

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Bassem Mansour ; Hajar Nasser ; Hussein Juniedi **All Authors**

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Abstract

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Abstract:
 The Sediment Microbial Fuel Cell (SMFC) has been studied in terms of electrical power generation, and water treatment. The study aimed to design and test a Sediment Microbial Fuel Cell (SMFC) and for electrical power generation and water treatment. The sediment has been obtained from Al-Sonobar River bed. It has been characterized to determine the organic matter content and nutrients. The cell has been equipped with a surface aeration system. The electrical current and water pollution indicators have been observed and recorded over time for two-mode aeration systems. Results of the first mode showed that the greatest value for Short Circuit Current (I_{SC}) was (0.605) mA while the greatest value for Open Circuit Voltage (V_{OC}) was (0.390) V. While a rise in current and voltage values has been observed in the second mode of aeration, in which the greatest value of Short Circuit Current was (1.240) mA, and the greatest value of Open Circuit Voltage (0.430) V. When the circuit has been connected to an external resistance ($R=100$) Ω , the values for the current, voltage, current density and power density were (0.805) mA, (0.084) V, (3.18) mA/m², and (0.269) mW/m², respectively. For water analysis, an increase in pH values of (9.90) was observed. The efficiency of removing Chemical Oxygen Demand (COD), phosphates, nitrates and Total Dissolved Solids (TDS) has also increased, reaching: 72.11%, 62.70%, 35.60%, 30.61%, respectively.

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I. Introduction
 With an increasing global population, the demand for energy is increasing. According to the International Energy Agency (IEA), the world's energy demand is projected to increase by 2035 to 2.5 times the current level, reaching 17.2 billion tons of oil equivalent (BOE) per year.

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- Authors**
- Bassem Mansour
Higher Institute for Environmental Research, Tishreen University, Latakia, Syria
 - Hajar Nasser
Faculty of Sciences, Tishreen University, Latakia, Syria
 - Hussein Juniedi
Higher Institute for Environmental Research, Tishreen University, Latakia, Syria
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